

Resilient Building Toolkit Adaptation Measures Factsheet

Name and description of measure: Chilled ceilings and chilled beams

Chilled ceilings and chilled beams use closed-circuit water-based systems as the heat transfer method. Water is pumped through such a cooling system, absorbing and removing heat from an occupied space as it flows through the system.

Chilled Ceiling: panel is constructed from a copper cooling element, which is bonded to the rear of a metal ceiling tile. Chilled ceiling systems work by radiating energy (cooling) downwards which, in turn, cools an occupied space's occupants and contents rather than directly cooling the room air. Chilled ceiling systems are durable with lifecycles of 25 years and can incorporate acoustic absorption pads in the rear of the ceiling tile. Tiles are usually square or rectangular, but can be manufactured in a range of shapes and sizes to incorporate particular room or building requirements.

Chilled beam: also features a copper cooling element at its core. Aluminum heat-transfer fins are bonded to this element, increasing its surface area and cooling potential. The fins are spaced further apart than, for example, a fan coil, to allow the air to pass across the coil by natural convection. They do not have fans or filters and can provide cooling with relatively high water temperatures. Suspended directly from the soffit, a beam is then either covered in a stand-alone metal casing or installed above a suspended ceiling system that incorporates a large open area for the air to pass through. Rather than radiation, chilled beams use convection to deliver the cooling. There are two different types of chilled beams:

- Passive chilled beams rely on natural convection to provide cooling. As the warmed air in an occupied space rises, it is drawn into the chilled beam/cooling element and chilled, before returning downwards to provide cooling to the space below. The higher the temperature of the air, the more air that passes over the chilled beam and, potentially, the higher the amount of cooling that is provided.
- Active chilled beams incorporate a ducted air supply. As conditioned air is introduced and passed through the chilled beam it induces warm air (from the room below) through the cooling element. This air is then cooled, mixed with the conditioned air and returned to the occupied space.

Cost of measure (high, medium or low):

High.

Pros and Cons:

Pros

Flexible use of available space.
Can be used as heating system.
Unit price lower than fan coil and variable air systems.
Low maintenance.
Simple user controls.

Cons

No energy allowance under Building Regulations.
Airflow may be greater than required.
A separate ventilation system is required to supply fresh air to the space.

Effectiveness of measure (high, medium or low):

High: Radiant ceilings and chilled beam systems (passive and active) have long lives and very low maintenance. Manufacturers now offering multi-purpose chilled beams to include light fixtures and sprinklers, as well as cooling

Chilled beams and chilled ceilings require a relatively modest cooling water temperature (14–17°C), which can be obtained using natural cold water storage or free cooling from outside air over periods of the year, depending on climate. Also, when mechanical cooling is used, a better energy performance can be achieved because of the higher chiller CoP (coefficient of performance).

Where chilled beams are used for heating, the situation is similar in that it is possible to use low temperature heat sources or heat pumps with water flow temperatures of typically 30–45°C.

Photos:

Radiant chilled ceiling



Radiant and convective chilled raft / sails



Convective chilled ceiling system



Perimeter passive chilled beam



Radiant / convective passive chilled beam



Two way discharge active chilled beam



One way discharge active chilled beam



Four way discharge active chilled beam



Product review site:

BS EN 14240: 2004 Ventilation for buildings – Chilled ceilings – Testing and rating.

BS EN 14518: 2005 Ventilation for Buildings – Chilled beams – Testing and rating of passive chilled beams.

BS EN 15116: 2008 Ventilation for Buildings – Chilled beams – Testing and rating of active chilled beams.

<http://www.building.co.uk/cpd-module-november-07-chilled-ceilings-chilled-beams-and-integrated-service-modules-alternative-approaches-to-cooling/3098970.article>